

# Performance of the Wheeler North Reef

## Annual Review Workshop for SONGS Reef Mitigation



April 10, 2017



**SONGS Mitigation Monitoring Project**  
**Marine Science Institute, University of California Santa Barbara**

# Performance Standards

*Used as a measuring stick to evaluate whether the Wheeler North Reef compensates for kelp forest loss caused by SONGS*

**1. *Absolute standards:* Measured against a fixed value at Wheeler North Reef only.**

**(e.g., 150 acres of giant kelp, 28 tons of fish biomass)**

**2. *Relative standards:* Must be similar to natural reefs.**

**(e.g., the abundance and number of species of algae and macroinvertebrates must be similar to that of natural reefs)**

# Absolute Performance Standards

## Requirement

Wheeler North Reef must meet each absolute performance standard in a given year for that year to count towards mitigation credit.

## Method of Evaluation

The evaluation of each absolute performance standard is based on the value for the current year, or the 4-yr average value calculated from the current year and the previous three years, *which ever is higher*.

## Rationale

Absolute performance standards are based on average annual losses caused by SONGS and all of them need to be met to insure that the lost resources are replaced.

# Absolute Performance Standards for Wheeler North Reef



*At least 90 percent of the exposed hard substrate must remain available for attachment by reef biota*



*The artificial reef(s) shall sustain 150 acres of medium-to-high density giant kelp*



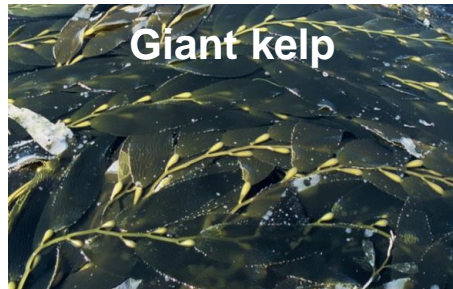
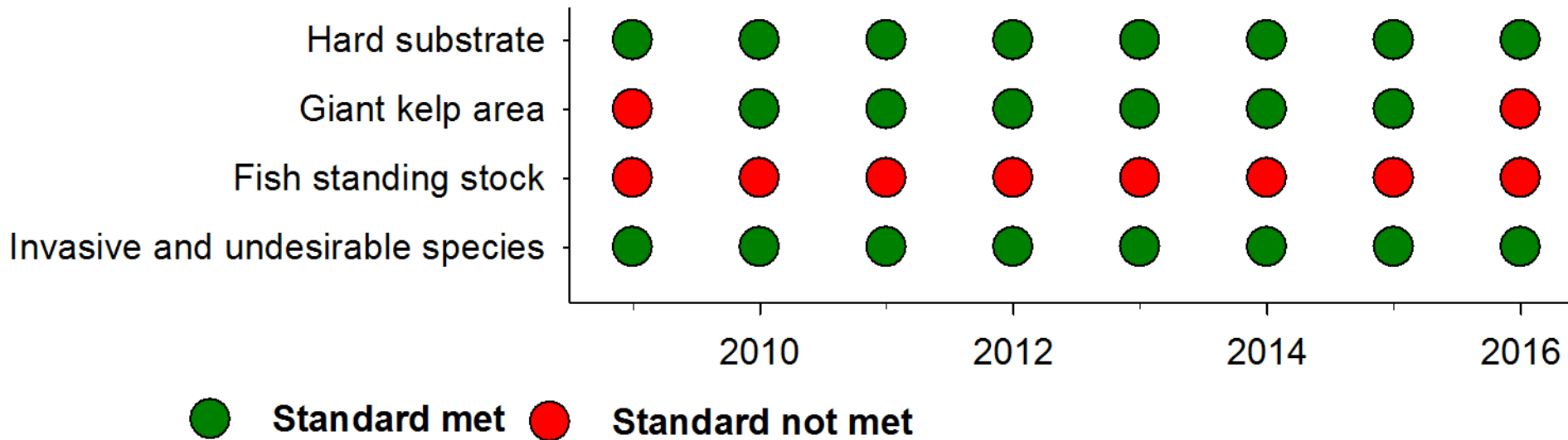
*The standing stock of fish at the mitigation reef shall be at least 28 tons*



*The important functions of the reef shall not be impaired by undesirable or invasive benthic species*

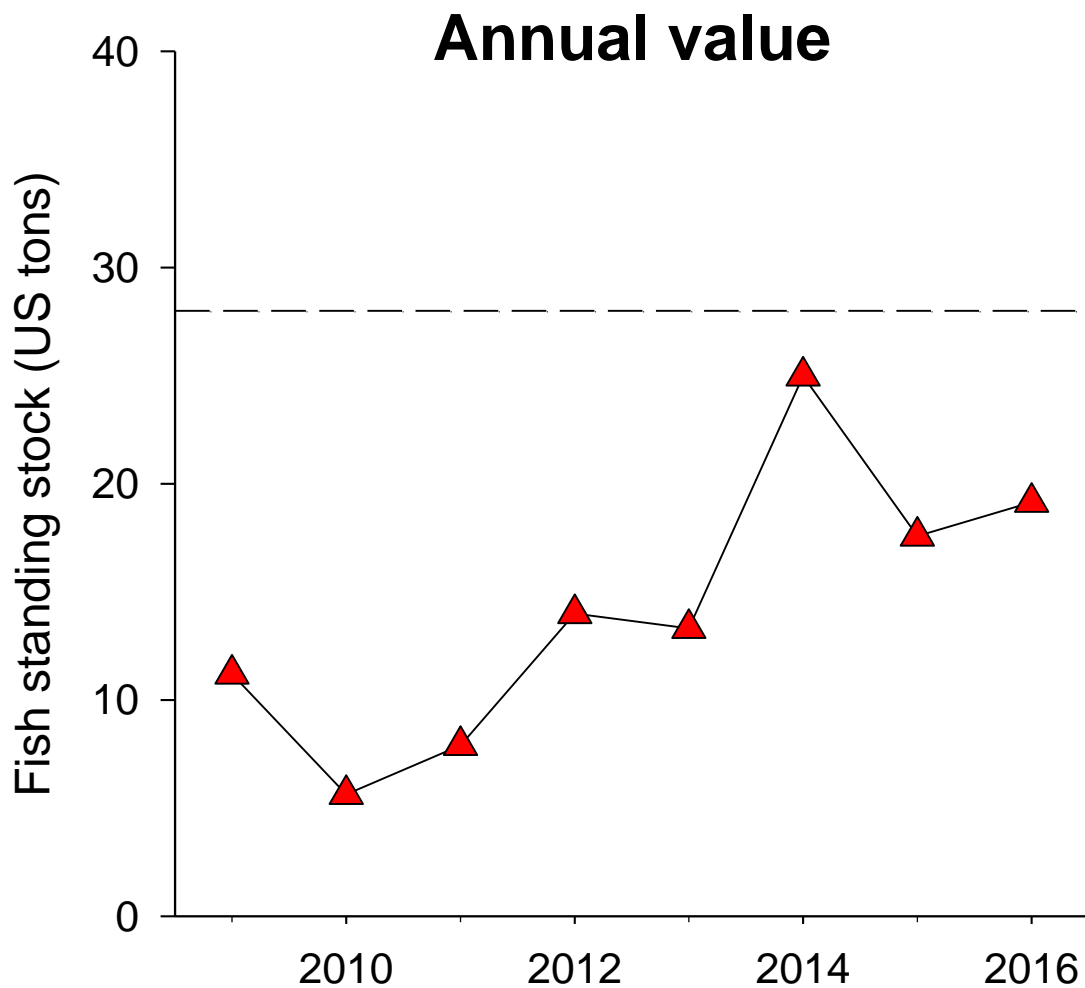


# Absolute Performance Standards

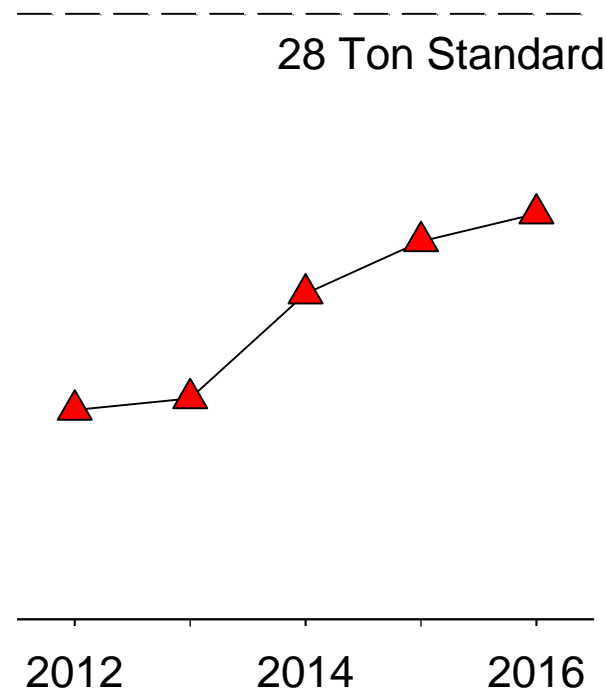


# Performance Standard: Fish Standing Stock

*The standing stock of fish at the mitigation reef shall be at least 28 tons*

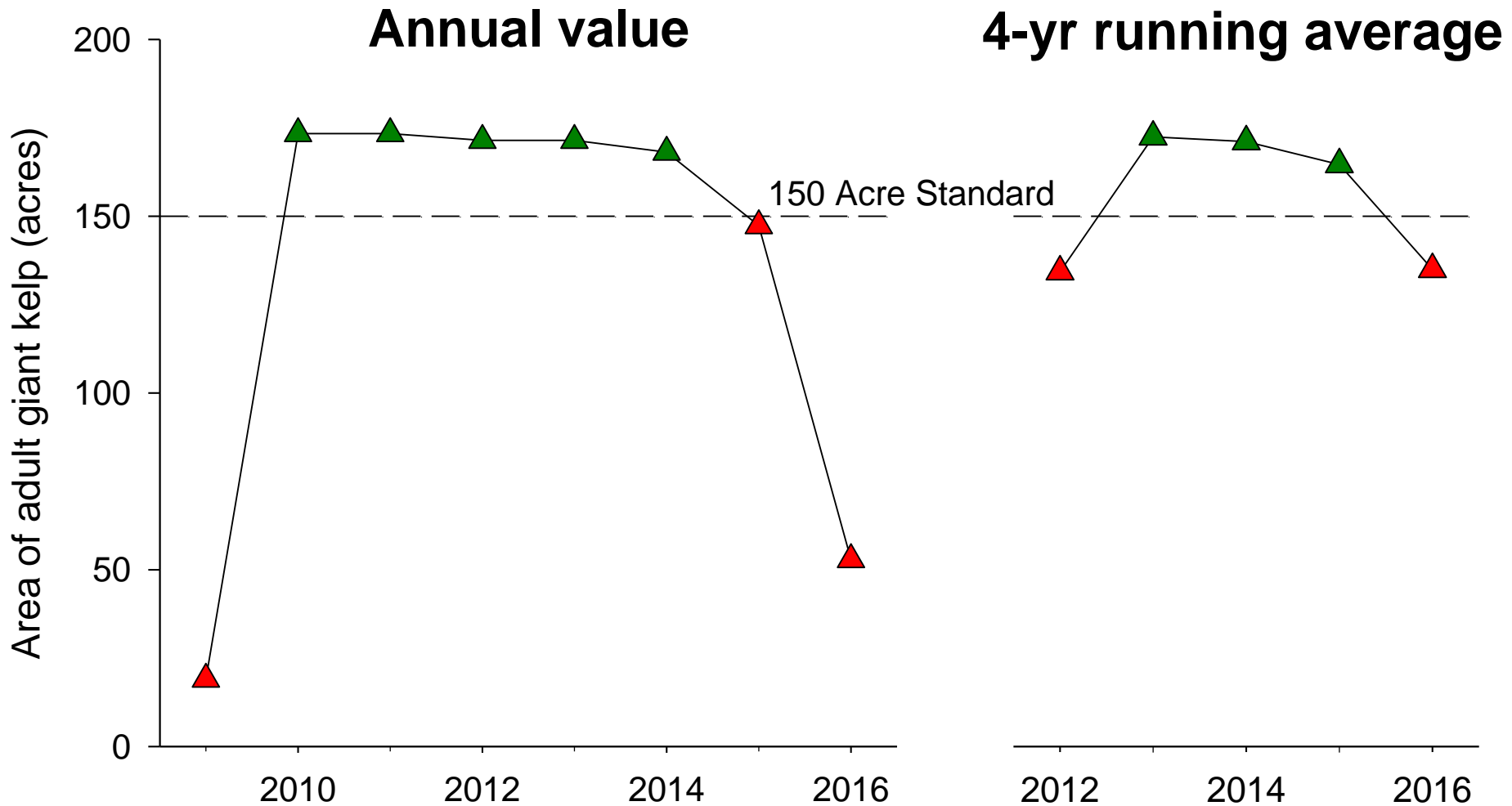


### 4-yr running average



# Performance Standard: Giant Kelp

*The artificial reef(s) shall sustain 150 acres of medium-to-high density kelp*



# **Relative Performance standards**

*(require comparison to natural reference reefs)*

**RATIONALE:** To be successful the Wheeler North Reef must sustain a kelp forest community that is *similar* to those of natural reefs in the region.

**Criteria for reference reef selection:**

- 1) history of sustaining giant kelp**
- 2) occur at a depth similar to that of the artificial reef**
- 3) primarily low relief, preferably consisting of cobbles and boulders**
- 4) located within the local region**

**The kelp forests at San Mateo and Barn best met these criteria**





Wheeler North Reef  
(mitigation site)

San  
Clemente

San Mateo  
(reference site)

SONGS

Barn  
(reference site)

Oceanside



Project site

# ***What counts as similar when assessing the relative performance standards?***

***Definition of similar:*** The 4-year running average for a relative performance standard at Wheeler North Reef must *not be significantly less than* that at the reference reef having the lowest value for that performance standard.

## ***Rationale:***

- For a given relative performance standard, the Wheeler North Reef should perform at least as well as the lowest performing natural reef used as a reference



# Relative Performance Standards for Wheeler North Reef

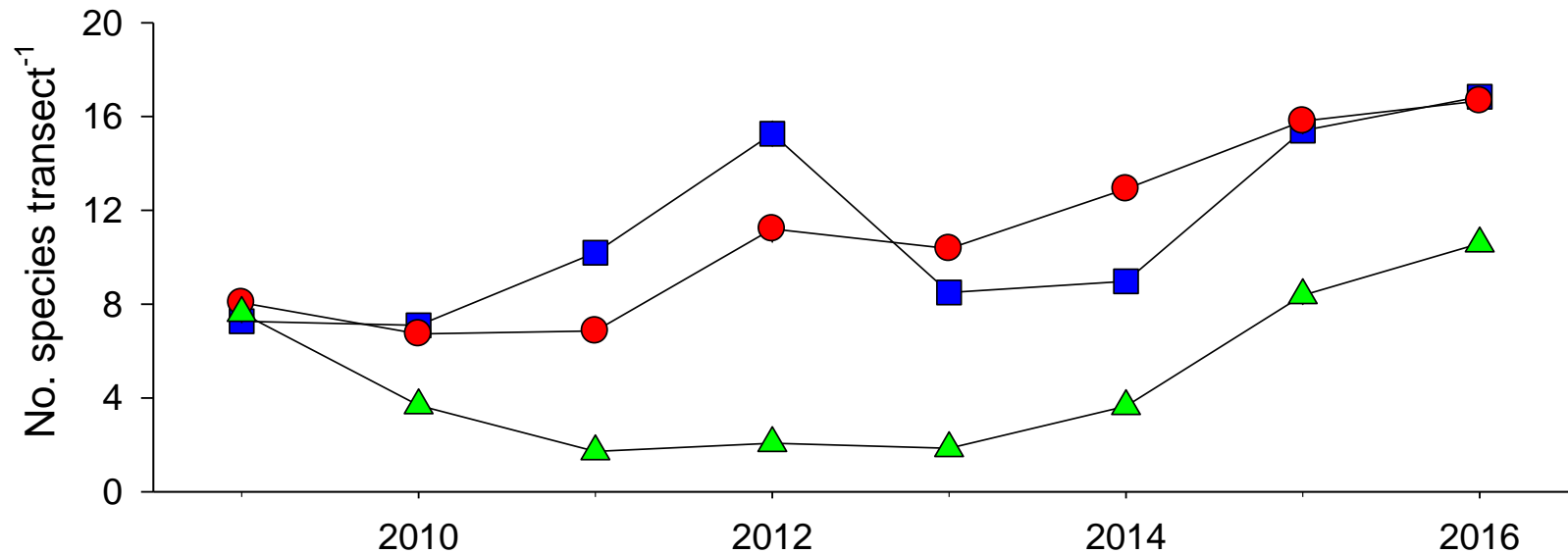
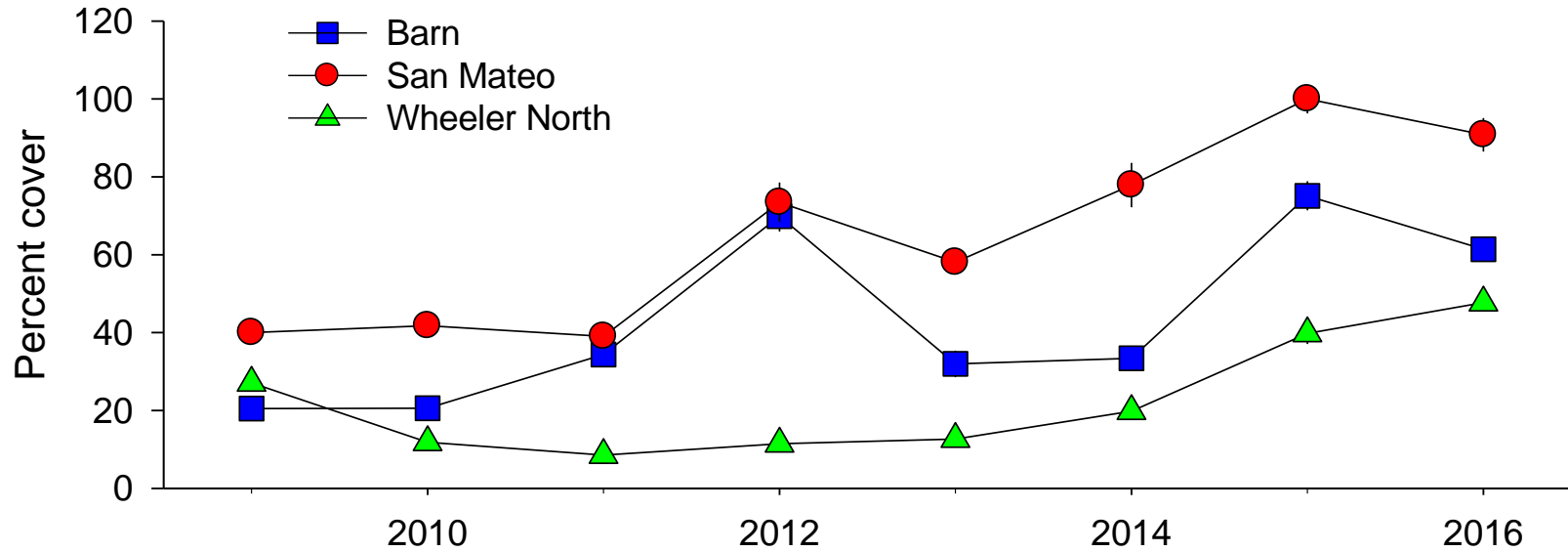
1. Algal percent cover
2. Algal species richness
3. Sessile invertebrate percent cover
4. Mobile invertebrate density
5. Invertebrate species richness
6. Resident fish density
7. Young-of-Year fish density
8. Fish species richness
9. Fish reproductive rates
10. Fish production
11. Food chain support





# Performance Standards: Understory algae

*The percent cover and number of species of algae must be similar to natural reefs within the region*

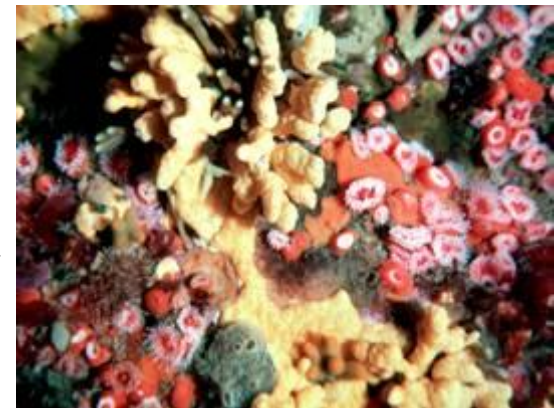
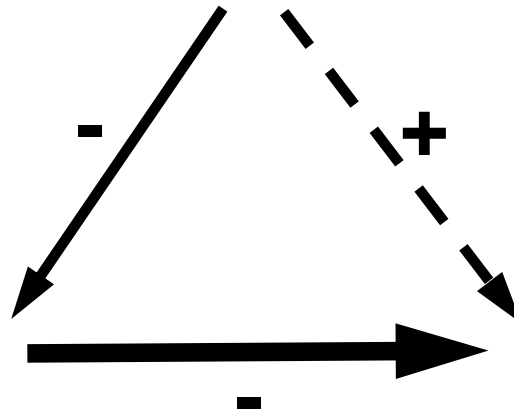




# Ecological interactions within the kelp forest



Understory algae

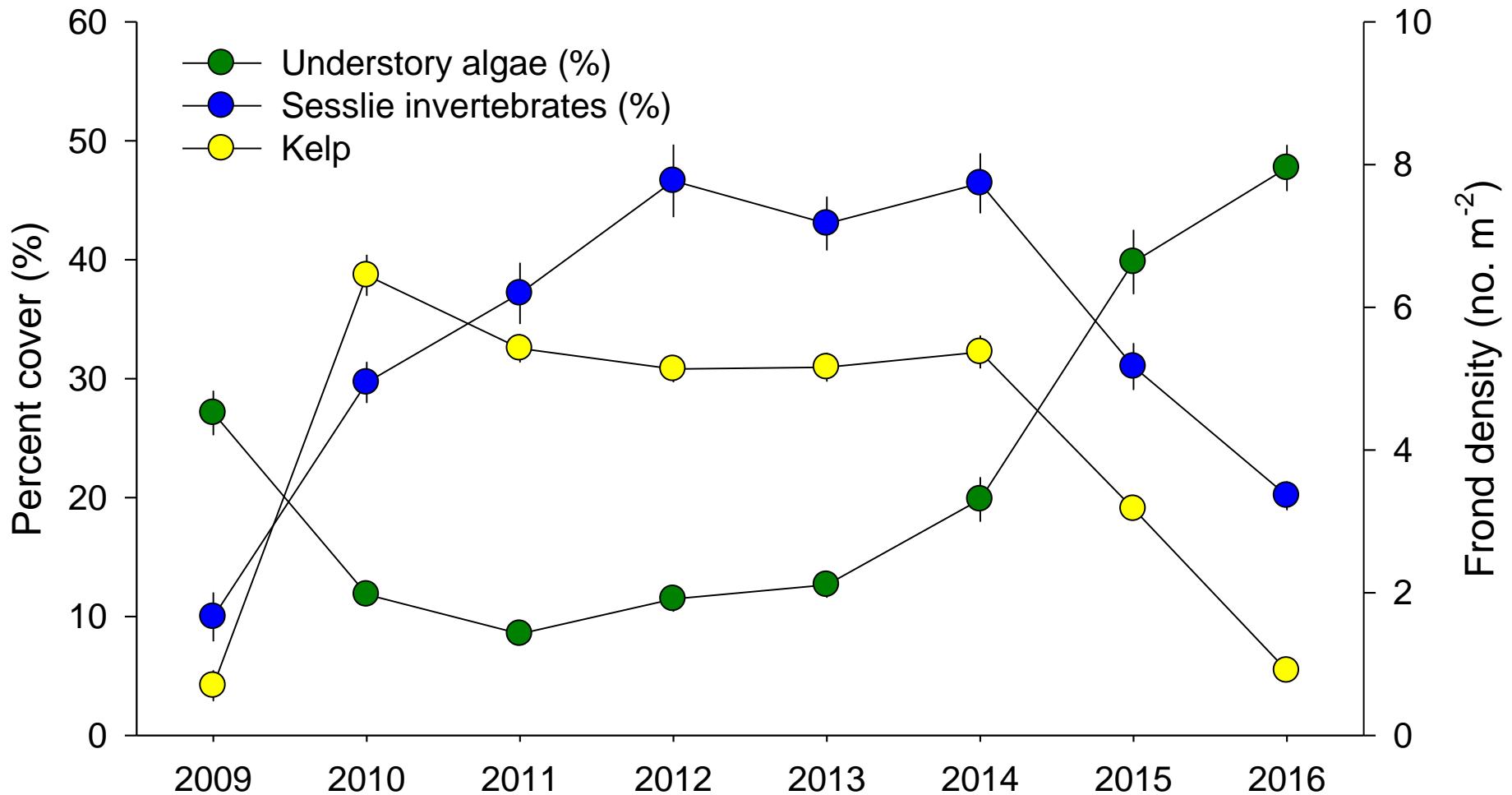


Sessile invertebrates

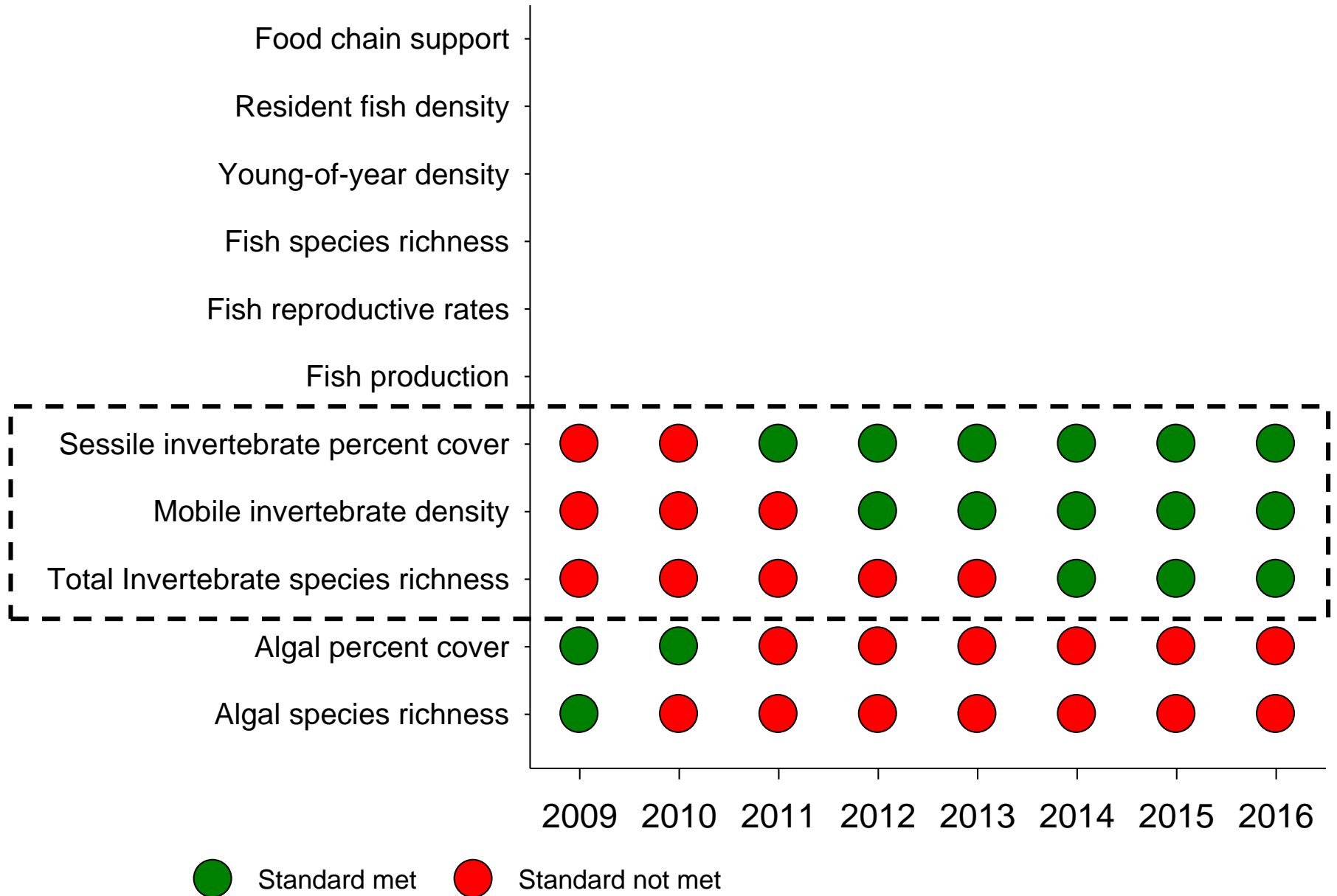
**Shading by giant kelp affects competition between understory algae and sessile invertebrates**

# Interactions with understory algae at WNR

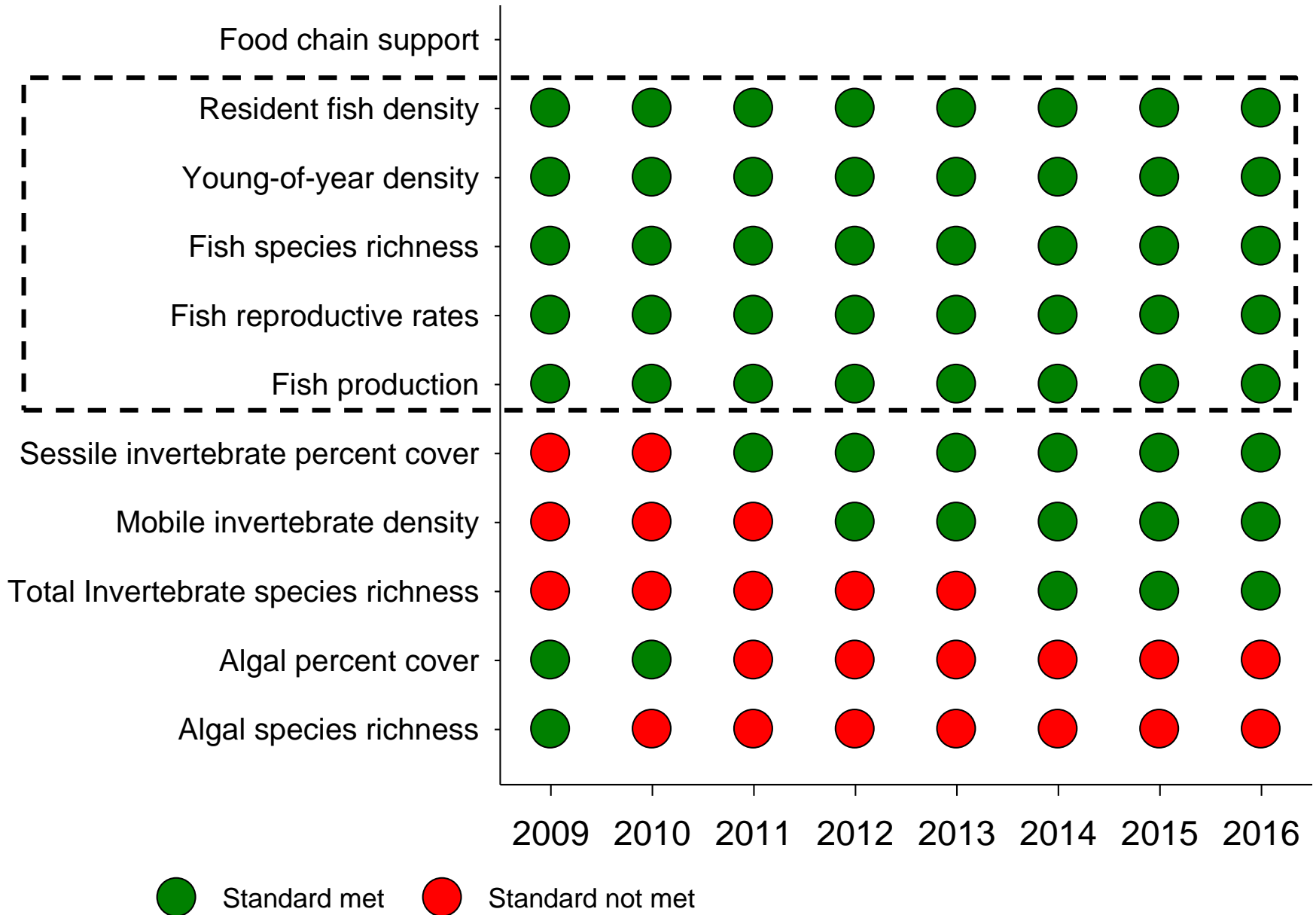
*The percent cover of understory algae at Wheeler North Reef has varied inversely with the percent cover of sessile invertebrates and the density of giant kelp*



# Relative Performance Standards



# Relative Performance Standards







# Relative Performance Standards

## **Requirement**

Wheeler North Reef (WNR) must meet as many relative standards as the lowest performing reference reef in a given year for that year to count towards mitigation credit.

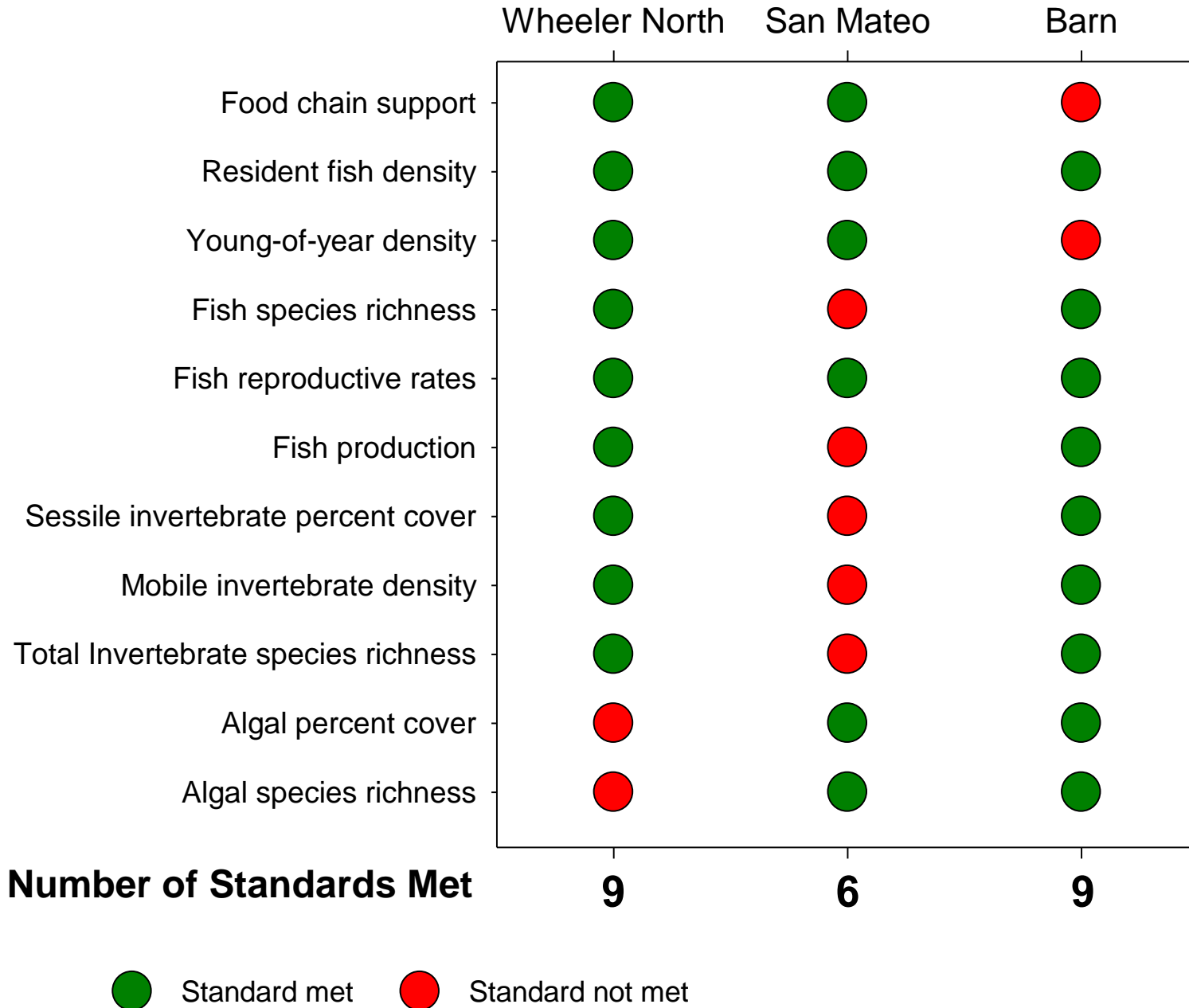
## **Method of Evaluation**

WNR and the reference reefs are evaluated with respect to each other to determine whether they meet each relative standard and the total number of relative standards met by each reef is tallied and compared.

## **Rationale**

Requiring WNR to meet at least as many relative standards as the reference reefs achieves the desired goal of WNR being similar to natural reefs without requiring it to consistently outperform them.

# Summary of relative performance standards in 2016



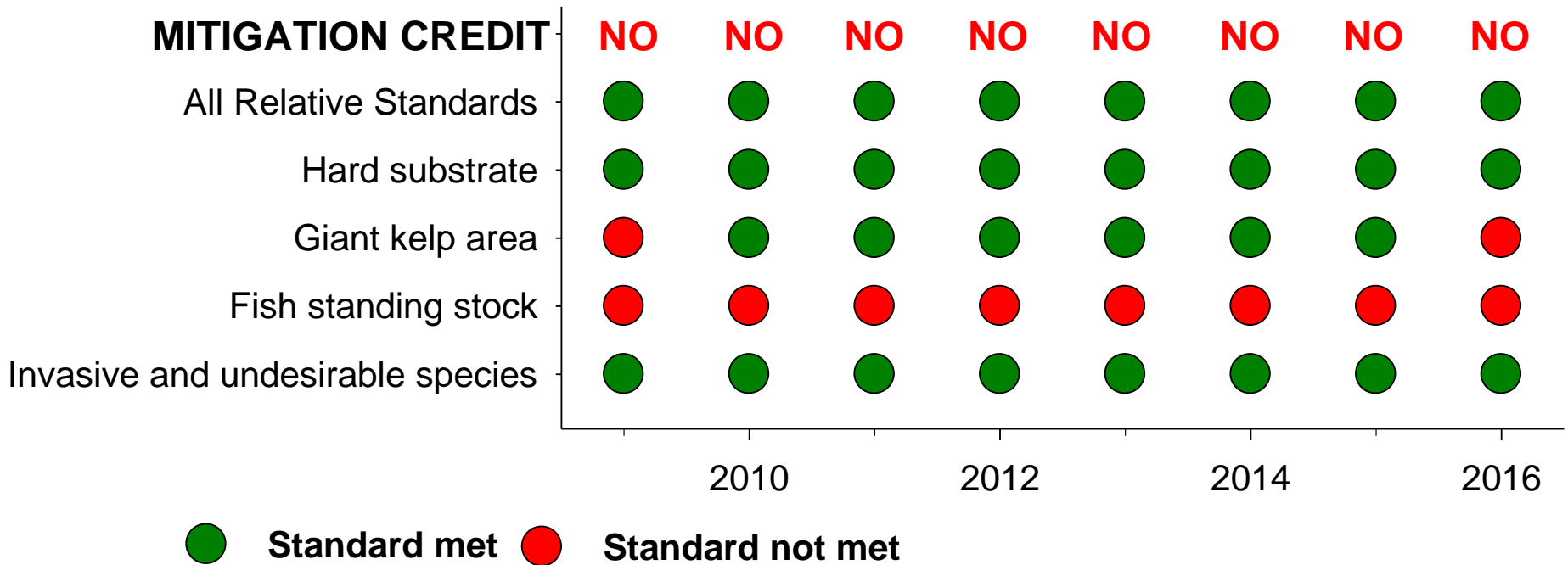
# SONGS Reef Mitigation Compliance

*Goal: Replace kelp forest resources lost by SONGS' operations*



- **One year of mitigation credit is given for each year that Wheeler North Reef meets the performance standards**
- **Fulfillment of the SONGS reef mitigation requirement occurs when the number of years of mitigation credit accrued by the Wheeler North Reef equals the total years of operation of SONGS Units 2 & 3, including the decommissioning period to the extent that there are continuing discharges**

# Summary of SONGS Reef Mitigation Compliance



Number of years of credit *needed* - at least **30**

Number of years of credit *earned* = **0**